Dioxins

Widespread pollutants, never intentionally made by humanity

‘Dioxins’ are a group of chemical compounds that are 
unintentional by-products of certain industrial, non-
industrial and natural processes, often related to combustion. They are persistent organic pollutants with 
the many different types of dioxin varying greatly in toxicity, from harmless to very toxic. One of these diox-
in compounds, called ‘TCDD’, is the best studied but most toxic form of dioxin.

A family of 210 compounds
This large product family consists of no less than 75 
dioxins and 135 closely related compounds called 
‘furans’. The abbreviation of the chemical name is 
PCDD for the dioxins, PCDF for furans. They are 
found throughout the world in the environment at 
very low concentrations. Due to this fact, we all 
have some ‘background exposure’ at levels not ex-
pected to affect human health.

Dioxin and furan molecules are composed of car-
bon, oxygen, hydrogen and chlorine atoms, the lat-
ter two occurring in variable numbers.

Properties of dioxins
Because they have a melting point of about 320°C, 
dioxins are solid at ambient temperature. Howev-
er, in combustion processes, dioxin molecules can 
be released and dispersed in air.

Dioxins are practically insoluble in water, but are 
soluble in oils and fats. As a consequence, they 
readily adsorb and accumulate in organic matter, 
sediments, suspended solids, fly ash, soot and the 
fatty tissues of organisms. Dioxins is not found at 
significant levels in water, except adsorbed onto 
solid particles in suspension.

How can we be exposed to dioxins?
As dioxins are soluble in fats, more than 90% of hu-
man exposure to dioxins is via food, mainly meat 
and dairy products, fish and shellfish.

When accidents in the food chain occur, a second-
ary contamination of the food supply can take 
place. In 1999 for instance, high levels of dioxins 
were found in poultry and eggs in Belgium. The 
cause was traced to animal feed that was contami-
nated with non-edible, industrial oil containing di-
oxins. This should, of course, be strictly avoided.
Other sources can be gases from uncontrolled combustion sources or cigarette smoke.

Very low levels of dioxins have been detected in ambient air. Some attaches to particulates and eventually settle in sediments, soils, grass or crops.

**Effects of dioxins on human health**

Only 17 of the 210 dioxin-family compounds have been reported to have toxic effects. Their toxicity level is compared to the most toxic dioxin, 2,3,7,8-TCDD and often expressed as TEF (Toxic Equivalency Factor).

**Short-term exposure** of humans to high levels of dioxins may result in skin lesions, such as chloracne and patch darkening of the skin, and altered liver function.

**Long-term exposure** is linked to impairment of the immune system, the nervous system, the endocrine system (hormone system) and reproductive functions. Chronic exposure of animals to dioxins has resulted in several types of cancer.

The dioxin family was evaluated by the World Health Organisation (WHO) and its International Agency for Research on Cancer (IARC) in 1997. Based on animal data and on human evidence, 2,3,7,8-TCDD was classified as ‘known human carcinogen, category 1’. However, TCDD does not affect genetic material, and there is a level of exposure below which cancer risk would be negligible.

(Source: [WHO Fact Sheet N°225, May 2010](http://www.who.int/mediacentre/factsheets/fs225/en/)).

Because dioxins are also soluble in milk fat, the debate has been going on for many years whether breast-feeding of infants is safe. Indeed, their daily intake during the (relatively short) breast-feeding period could be higher than the WHO daily safety level for a lifetime. Nevertheless, WHO’s position is that at current exposure levels, known benefits of breast-feeding outweigh any potential risks.

**How can we limit exposure?**

Trimming fat from meat and consuming low fat dairy products may decrease exposure to dioxin compounds. Also, a balanced and varied diet, including adequate amounts of fruit, vegetables and cereals will help to avoid excessive exposure from a single source. These measures are probably most relevant for pregnant women in order to reduce exposure of the developing foetus and when breast-feeding infants.

All EU countries have food contamination monitoring systems. These ensure that safety limits are not exceeded. Also, good controls and practices during food production, processing, distribution and sale are essential to the production of safe food.

In industry and waste incineration, strict control of the processes is necessary to reduce the formation of dioxins. Incineration of potentially contaminating material (like medical waste and hazardous waste) should only be done at temperatures above 850 °C in facilities equipped with proper exhaust gas treatment.

**Euro Chlor position**

- Euro Chlor supports further research to understand and quantify the effects of dioxins on human health.
- We favour the development of new processes and technologies to minimise the formation and emission of dioxin into the environment from industrial activities.
- Even though human exposure to dioxins is very low and unlikely to pose risks, we believe that raising the standards and environmental controls on incineration and production processes represent a positive step towards the further protection of public health.

Much more about chlorine on [www.eurochlor.org](http://www.eurochlor.org).
Chlorine chemistry applications: [www.chlorinethings.eu](http://www.chlorinethings.eu)